

Model GD-1024 Telephone Amplifier

HEATH COMPANY

BENTON HARBOR, MICHIGAN

MODEL GD-1024 Telephone Amplifier



HEATHKIT[®] ASSEMBLY MANUAL

RUSH



Copyright © 1973
Heath Company
All rights reserved

I-595-1543-01

Dear Customer:

The Heathkit electronic product you have purchased is one of the best performing electronic products in the world.

Here's how we aim to keep it that way:

Your Heathkit Warranty

During your first 90 days of ownership, any parts which we find are defective, either in materials or workmanship, will be replaced or repaired free of charge. And we'll pay shipping charges to get those parts to you — anywhere in the world.

If we determine a defective part has caused your Heathkit electronic product to need other repair, through no fault of yours, we will service it free — at the factory, at any retail Heathkit Electronic Center, or through any of our authorized overseas distributors.

This protection is exclusively yours as the original purchaser. Naturally, it doesn't cover damage by use of acid-core solder, incorrect assembly, misuse, fire, flood or acts of God. But, it does insure the performance of your Heathkit electronic product anywhere in the world — for most any other reason.

After-Warranty Service

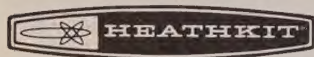
What happens after warranty? We won't let you down. If your Heathkit electronic product needs repairs or you need a part, just write or call the factory, your nearest retail Heathkit Electronic Center, or any Heath authorized overseas distributor. We maintain an inventory of replacement parts for each Heathkit model at most locations — even for many models that no longer appear in our current product line-up. Repair service and technical consultation are available through all locations.

We hope you'll never need our repair or replacement services, but it's nice to know you're protected anyway — and that cheerful help is nearby.

Sincerely,

HEATH COMPANY
Benton Harbor, Michigan 49022

Assembly and Operation of the



TELEPHONE AMPLIFIER

Model GD-1024



TABLE OF CONTENTS

Introduction	2
Parts List	2
Assembly Notes	5
Step-by-Step Assembly	5
Circuit Board Assembly	5
General Assembly	10
Operation	16
In Case of Difficulty	17
Troubleshooting Chart	18
Voltage Chart	19
Specifications	20
Circuit Description	21
Chassis Photograph	22
Circuit Board X-Ray View	23
Schematic. . . (fold-out from page)	23
Warranty	Inside front cover
Customer Service	Inside rear cover

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

INTRODUCTION

The Heathkit Model GD-1024 Telephone Amplifier is a special amplifier and speaker system that gives you the convenience of a hands-free telephone conversation, for one or several people. Either at home or in an office you can converse while you proceed with other tasks. At the same time other concerned persons can get the message first hand.

This smart design with its acoustic pick-up method is compatible with all telephone handsets and does not require electrical or mechanical connection to the phone system. Your Telephone Amplifier is easy to build, simple to operate, and will give years of dependable service.

The famous Heathkit assembly procedures and methods used with the larger Heathkit products are used with this Telephone Amplifier. This means every effort was made to make the assembly of this kit easy and enjoyable.

Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures. Be sure to pay special attention to the soldering section.

PARTS LIST

Check each part against the following list. The Parts Pictorial will show you what the parts look like.

Any part that is in an individual envelope with a part number on it should be placed back in its envelope after it is identified until it is called for in a step.

KEY PART	PARTS	DESCRIPTION	PRICE	
<u>No.</u>	<u>No.</u>	<u>Per Kit</u>	<u>Each</u>	
RESISTORS				
1	1-143	2	2.7 Ω , 5% (red-violet-gold-gold)	.10
	1-49	1	22 Ω (red-red-black)	.10

The key numbers correspond to the numbers in the Parts Pictorial (fold-out from Page 5). To order a replacement part, use the Parts Order Form furnished with this kit. If one is not available, see "Replacement Parts" inside the rear cover of this Manual.

KEY PART	PARTS	DESCRIPTION	PRICE
<u>No.</u>	<u>No.</u>	<u>Per Kit</u>	<u>Each</u>
Resistors (cont'd.)			
1-151	1	330 Ω , 5% (orange-orange-brown-gold)	.10
1-97	1	1100 Ω , 5% (brown-brown-red-gold)	.10
1-13	1	2700 Ω (red-violet-red)	.10

KEY PART No.	PARTS No.	DESCRIPTION	PRICE Each
-----------------	--------------	-------------	---------------

Resistors (cont'd.)

1-16	1	4700 Ω (yellow-violet-red)	.10
1-20	3	10 k Ω (brown-black-orange)	.10
1-115	2	47 k Ω , 5% (yellow-violet-orange-gold)	.10
1-71	1	4.7 M Ω (yellow-violet-green)	.10

CONTROL

2	10-958	1	100 k Ω control	.80
---	--------	---	------------------------	-----

CAPACITORS

3	21-140	1	.001 μ F disc (k)	.10
	21-16	2	.01 μ F disc (k)	.10
	21-31	1	.02 μ F disc (k)	.10
4	25-115	2	10 μ F electrolytic	.40
	25-116	1	50 μ F electrolytic	.50
	25-117	1	100 μ F electrolytic	.50

KEY PART No.	PARTS No.	DESCRIPTION	PRICE Each
-----------------	--------------	-------------	---------------

TRANSISTORS

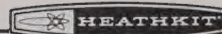
NOTE: Transistors are marked for identification in one of the following four ways:

1. Part number.
2. Transistor type number.
3. Part number and transistor type number.
4. Part number with a transistor type number other than the one listed.

5	417-201	2	X29A829	.50
	417-801	3	MPSA20	.20

PLASTIC PARTS

6	73-126	1	Pad	.55
7	73-127	1	Foam disc	.10
8	75-138	8	Foot	.10
9	92-88	1	Amplifier case	.75
10	92-89	1	Amplifier bottom panel	.45
11	92-90	1	Speaker case	.45
12	92-91	1	Speaker bottom panel	.25
13	207-91	1	Battery strap	.10



KEY PART No.	PARTS No.	PARTS Per Kit	DESCRIPTION	PRICE Each
-----------------	--------------	------------------	-------------	---------------

HARDWARE

14	250-420	4	#2 x 1/4" screw	.05
15	250-592	2	#6 x 3/8" screw	.05
16	252-159	1	1/4" - 32 nut	.05

MISCELLANEOUS

	73-39	1	Foam tape	.10
	85-1313-1	1	Circuit board	.75
17	204-1840	2	Bracket	.10
18	258-185	1	Contacto	.30
	343-11	1	Shielded cable	.10
	344-59	1	White wire	.05
19	401-163	1	Speaker	1.40
20	432-33	1	Battery connector	.25
21	462-395	1	Thumb knob	.35
22	480-67	1	Microphone (do not remove protective cap at this time)	4.55
	490-168	1	Wrench	.15
		1	Solder (Additional 3' rolls of solder, #331-6, can be ordered for 15 cents each.)	

KEY PART No.	PARTS No.	PARTS Per Kit	DESCRIPTION	PRICE Each
-----------------	--------------	------------------	-------------	---------------

Miscellaneous (cont'd.)

The following battery should be purchased at this time for use in the completed kit.

1	9-volt type, NEDA #1604 (such as Eveready #216, Burgess #2U6, RCA #VS 323, Ray-O-Vac #1604, etc.)
---	--

PRINTED MATERIAL

391-34	1	Blue and white identification label	
597-260	1	Parts Order Form	
597-308	1	Kit Builders Guide	
	1	Manual (See front cover for part number.)	2.00

The above prices apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Add 10% (minimum 25 cents) to the price when ordering from a Heathkit Electronic Center to cover local sales tax, postage, and handling. Outside the U.S.A. parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties, and rates of exchange.

ASSEMBLY NOTES

NOTE: Before you start to assemble this kit, read the "Kit Builders Guide" for information on wiring, soldering, and step-by-step assembly procedures.

You will install components on the lettered side of the circuit board in the following steps. Resistors and disc capacitors can be installed either way within their outline. However, electrolytic capacitors and transistors must be installed in a specific manner. "Notes" will show and tell you how to correctly install these parts. Read the entire step before you perform the operation and follow the instructions carefully.

The illustrations in this Manual are called Pictorials and Details. Pictorials show the overall operation for a group of assembly steps; Details illustrate a single

step. When you are directed to refer to a certain Pictorial "for the following steps," continue using that Pictorial until you are referred to another Pictorial for another group of steps.

All resistors will be called for by resistance values in Ω (ohms), $k\Omega$ (kilohms), or $M\Omega$ (Megohms), and the corresponding color bands. Capacitors will be called for by capacitance value (in μF) and type (disc or electrolytic).

SAFETY WARNING: Avoid eye injury when you clip off excess lead lengths. We suggest you wear glasses, or at least clip the leads so the ends will not fly toward your eyes.

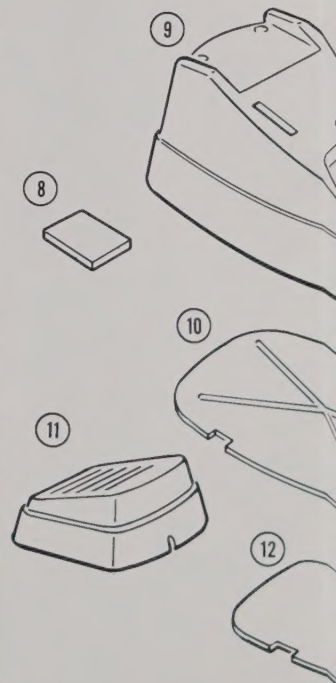
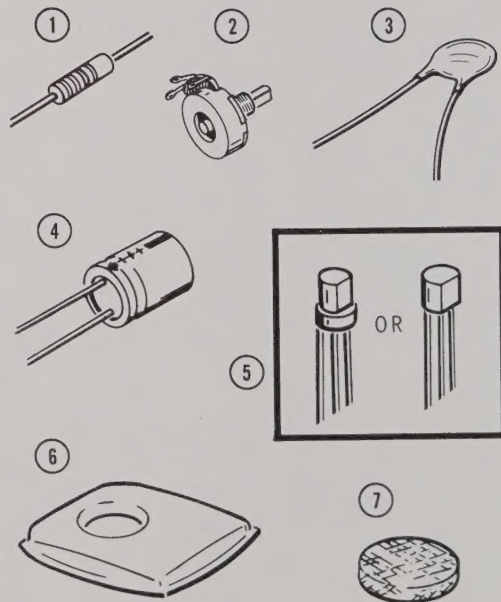
STEP-BY-STEP ASSEMBLY

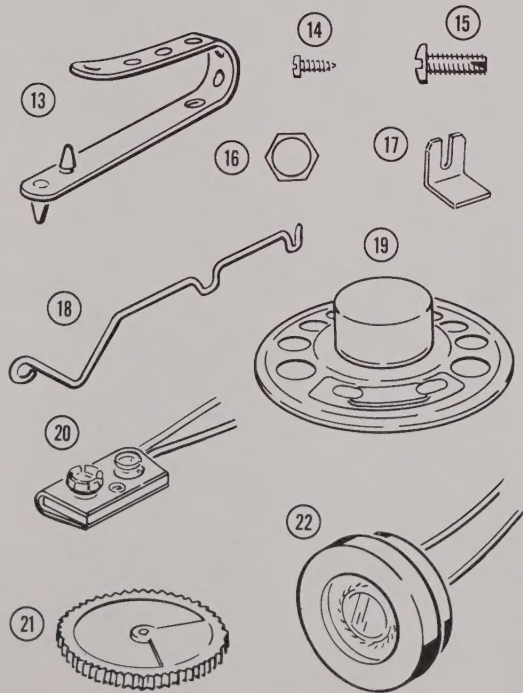
CIRCUIT BOARD ASSEMBLY

Locate the circuit board and place it lettered side up with the part number

positioned as shown in Pictorial 1. Then complete each step in sequence in the Pictorials.

PARTS PICT





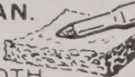
START



() 2.7 Ω , 5% (red-violet-gold-gold).
() 1100 Ω , 5% (brown-brown-red-gold).
() 330 Ω , 5% (orange-orange-brown-gold).
() 10 k Ω (brown-black-orange).
() 47 k Ω , 5% (yellow-violet-orange-gold).
() 10 k Ω (brown-black-orange).
() 4.7 M Ω (yellow-violet-green).

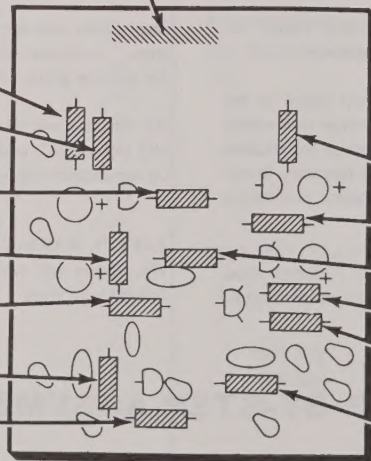
FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



() Solder all leads to the foil and cut off the excess lead lengths.

PART
NUMBER



CONTINUE



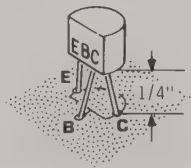
() 2.7 Ω , 5% (red-violet-gold-gold).
() 10 k Ω (brown-black-orange).
() 2700 Ω (red-violet-red).
() 22 Ω (red-red-black).
() 47 k Ω , 5% (yellow-violet-orange-gold).
() 4700 Ω (yellow-violet-red).
() Solder all leads to the foil and cut off the excess lead lengths.

PICTORIAL 1

START



NOTE: When you install a transistor, position the E, B, and C leads of the transistor into the corresponding E, B, and C holes of the circuit board. Position each transistor 1/4" above the circuit board. Solder all leads to the foil and cut off the excess lead lengths of each transistor after it is installed.



() MPSA20 transistor (#417-801) at Q4.

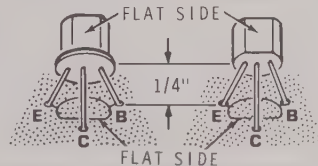
() MPSA20 transistor (#417-801) at Q3.

() MPSA20 transistor (#417-801) at Q1.

CONTINUE



NOTE: Install the following transistors in the manner shown. First line up the flat of the transistor with the outline of the flat on the circuit board. Insert the transistor leads into their correct holes indicated by E, C, and B. Solder each lead to the foil and cut off the excess lead length.



() X29A829 transistor (#417-201) at Q5.

() X29A829 transistor (#417-201) at Q2.

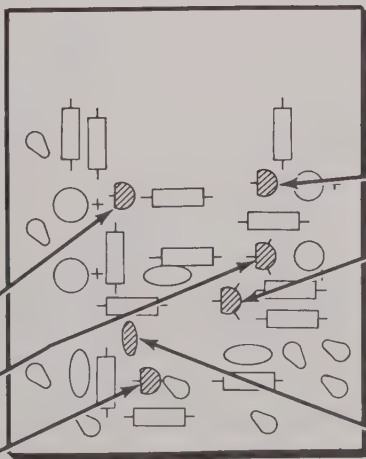
NOTE: Before you install disc capacitors in this kit, use long-nose pliers to remove the excess insulation from the capacitor leads.

REMOVE
INSULATION
ON LEADS



() .001 μ F disc.

Solder the leads to the foil and cut off the excess lead lengths.

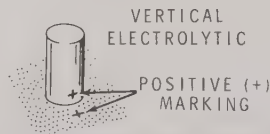


PICTORIAL 2

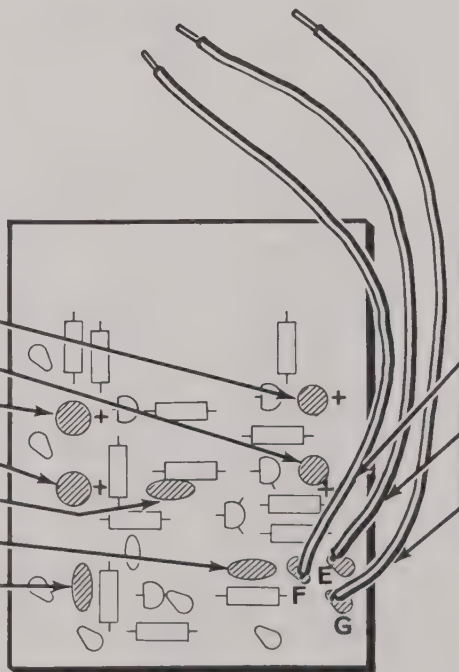
START



NOTE: When you install electrolytic capacitors, always match the positive (+) mark on the capacitor with the positive (+) mark on the circuit board.



- () 10 μ F electrolytic.
- () 10 μ F electrolytic.
- () 100 μ F electrolytic.
- () 50 μ F electrolytic.
- () .02 μ F disc.
- () .01 μ F disc.
- () .01 μ F disc.
- () Solder all leads to the foil and cut off the excess lead lengths.



PICTORIAL 3

CONTINUE



NOTE: When wiring this kit, you will be instructed to prepare lengths of wire ahead of time, as in the following steps. To prepare a wire, cut it to the indicated length and remove 1/4" of insulation from each end.

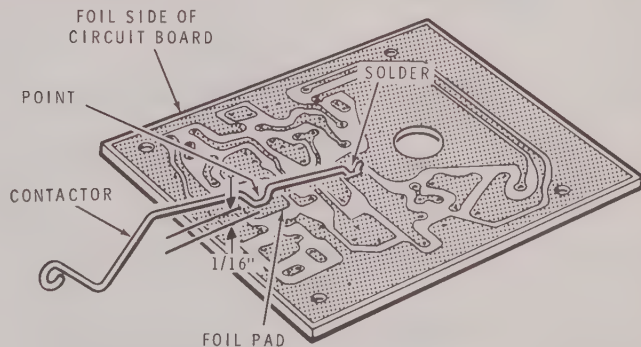
- () Prepare three 7" lengths of white wire.
- () Insert a bare end of a 7" wire in hole F and solder it to the foil.
- () Insert a bare end of a 7" wire in hole E and solder it to the foil.
- () Insert a bare end of a 7" wire in hole G and solder it to the foil.

Refer to Pictorial 4 for the following step.

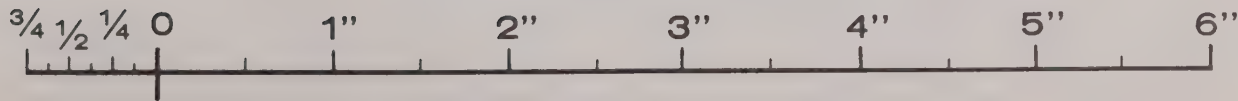
NOTE: In the following step you will install the contactor. It must be positioned so the weight of your telephone handset placed on your unit will turn on the amplifier. Also the amplifier must turn off when the handset is removed.

() Install the contactor to the circuit board as follows:

1. Solder the formed end into the slot as shown.
2. Reheat the connection and position the point of the contactor approximately $1/16''$ above the foil pad.
3. Be sure a $1/8''$ movement at the free end will cause the point to contact the foil pad.



PICTORIAL 4



GENERAL ASSEMBLY

Wiring

Refer to Pictorial 5 (fold-out from Page 11) for the following steps.

- () Prepare the shielded cable in the following manner: Tie simple knots in the shielded cable, 7" from one end and 3" from the other end. Refer to Detail 5A and prepare both shielded cable ends.

NOTE: In the following steps, (S-1) means to solder the connection.

- () Connect the center lead of the 7" shielded cable end to hole D (S-1).
- () Connect the shield lead to hole C (S-1).

Locate the control and connect the three white wires coming from the circuit board in the following manner:

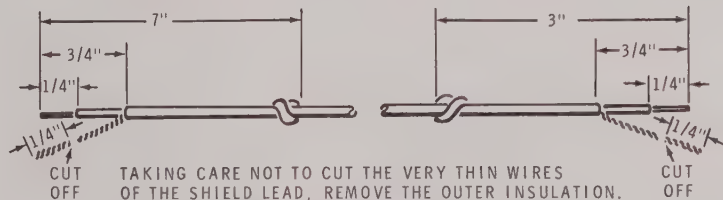
- () White wire from hole E to lug 1 of the control (S-1).
- () White wire from hole F to lug 2 of the control (S-1).
- () White wire from hole G to lug 3 of the control (S-1).

- () Locate the battery connector and connect the red lead to hole K in the circuit board (S-1).
- () Connect the black lead to hole H in the circuit board (S-1).
- () Connect the black lead from the microphone to hole B (S-1).
- () Connect the blue lead from the microphone to hole A (S-1).
- () Cut off the excess lead lengths from the foil side of the circuit board.

Circuit Board Checkout

Carefully inspect the circuit board for the following conditions.

- () Unsoldered connections.
- () "Cold" solder connections.
- () Solder bridges between foil patterns.
- () Protruding leads which could touch together.
- () Transistors for the proper type and installation.
- () Electrolytic capacitors for the correct position of the positive (+) end.



STRAIGHTEN OUT THE THIN WIRES OF THE SHIELD LEAD, TWIST HALF OF THEM TOGETHER, AND CUT OFF THE OTHER HALF OF THEM.

CUT OFF HALF THE WIRES

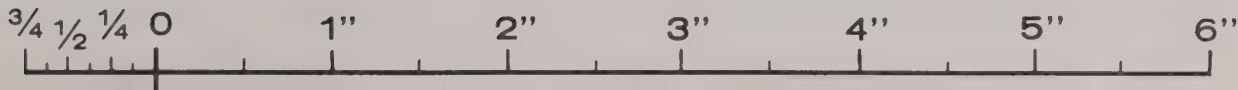


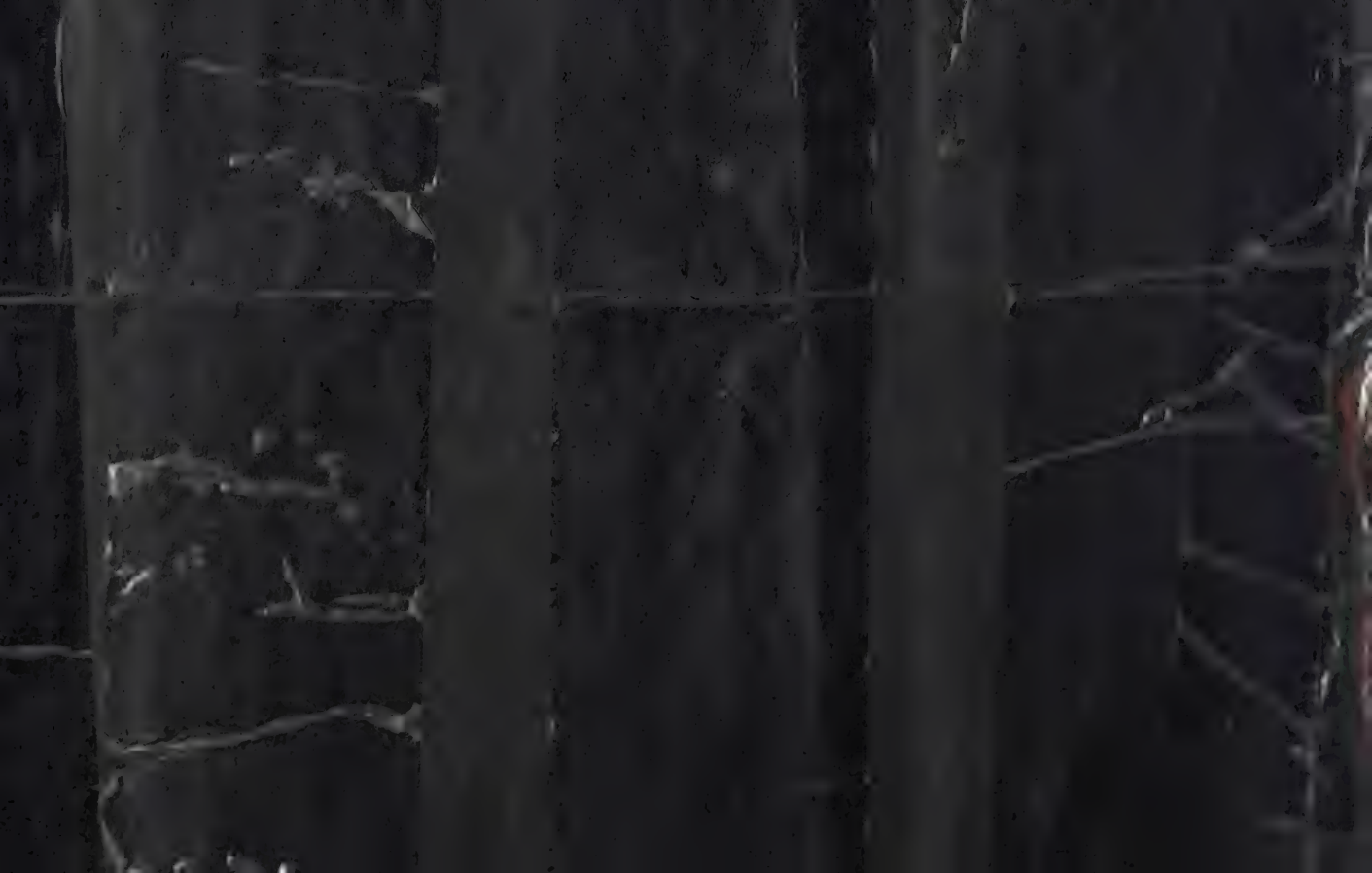
SHIELD LEAD

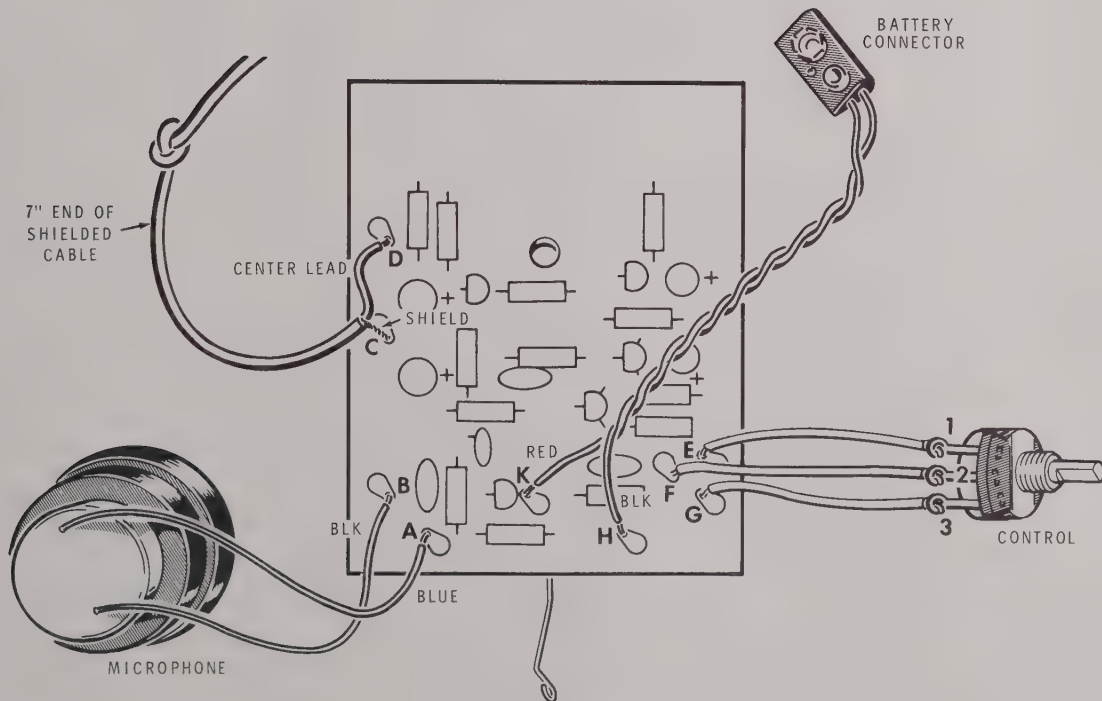
REMOVE THE INNER INSULATION. APPLY SMALL AMOUNTS OF SOLDER TO THE END OF THE SHIELD LEAD AND THE INNER LEAD.



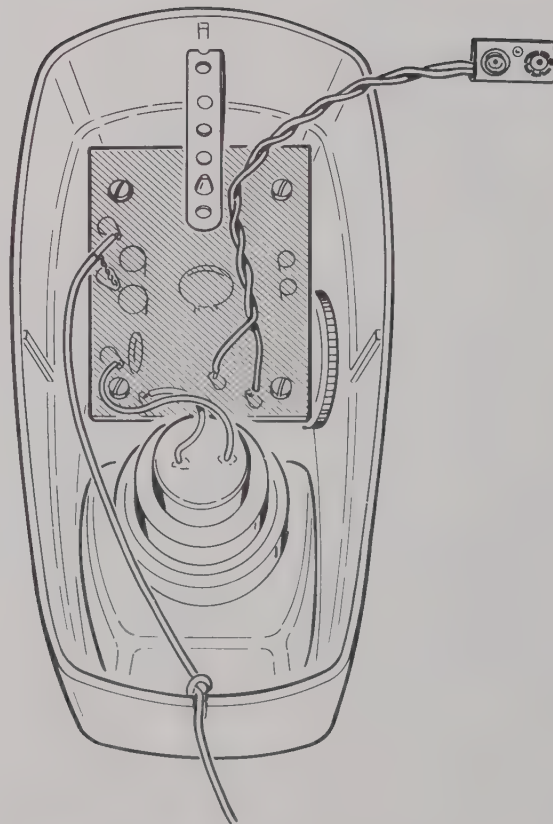
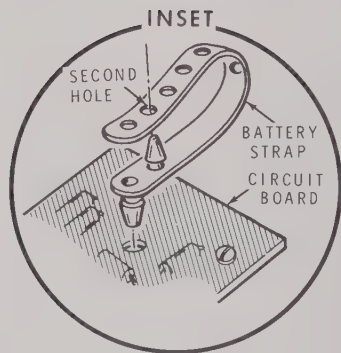
Detail 5A







PICTORIAL 5



PICTORIAL 6

Parts Mounting

Refer to Pictorial 6 for the following steps.

- () Refer to the inset drawing on Pictorial 6 and bend the battery strap around and snap it together as shown. Then snap the battery strap into the circuit board.

- () Start a 1/4"-32 nut on the control as shown in Detail 6A.

- () Press a thumb knob on the control shaft as shown in Detail 6A.

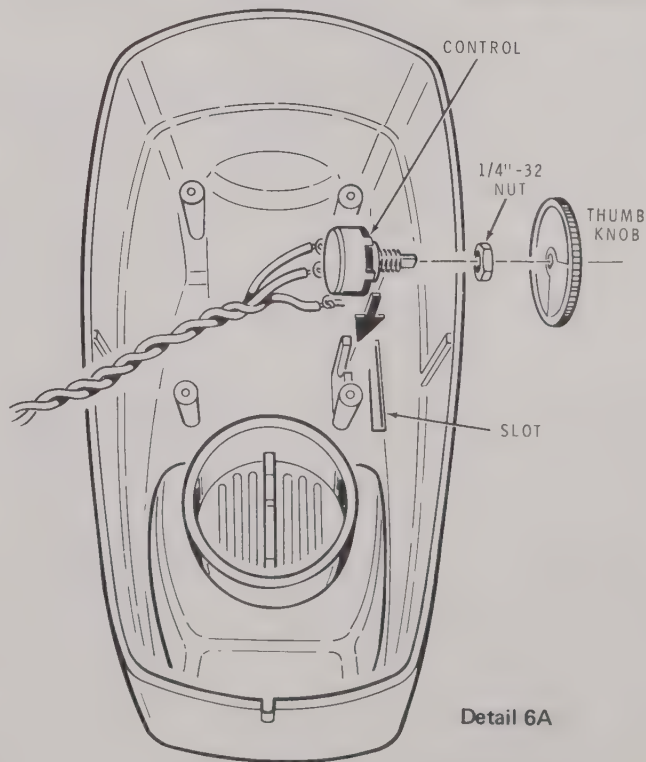
NOTE: In the following steps, cover your work surface with a cloth and place the amplifier case on the cloth as shown. Use the wrench supplied in this kit in the next step.

- () Twist the control and wires a few turns to group the wires. Be sure the lugs are not bent. Then mount the control in the amplifier case with the 1/4"-32 nut. Position the control lugs down and the thumb knob centered in the slot.

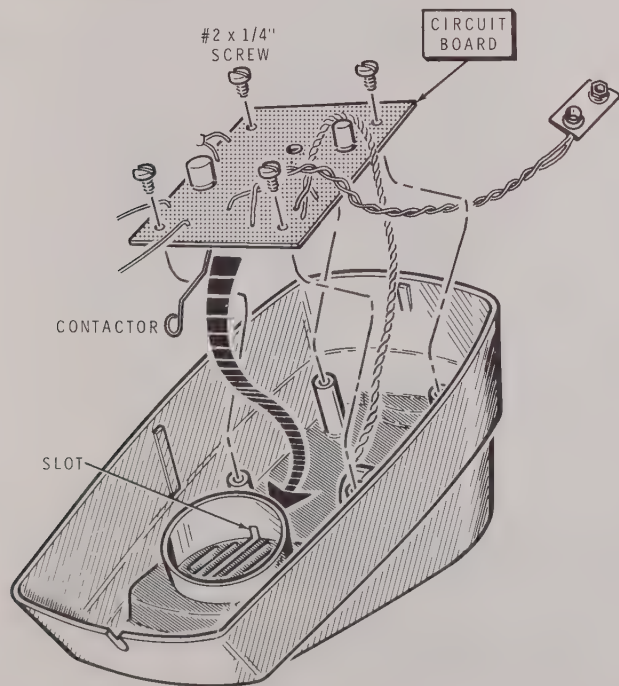
- () Place four #2 x 1/4" screws in the circuit board holes, insert the contactor through the slot, and mount the circuit board with the four screws as shown in Detail 6B. Position the control wires clear of the contactor and the control thumb knob.

- () Remove the protective cap from the microphone.

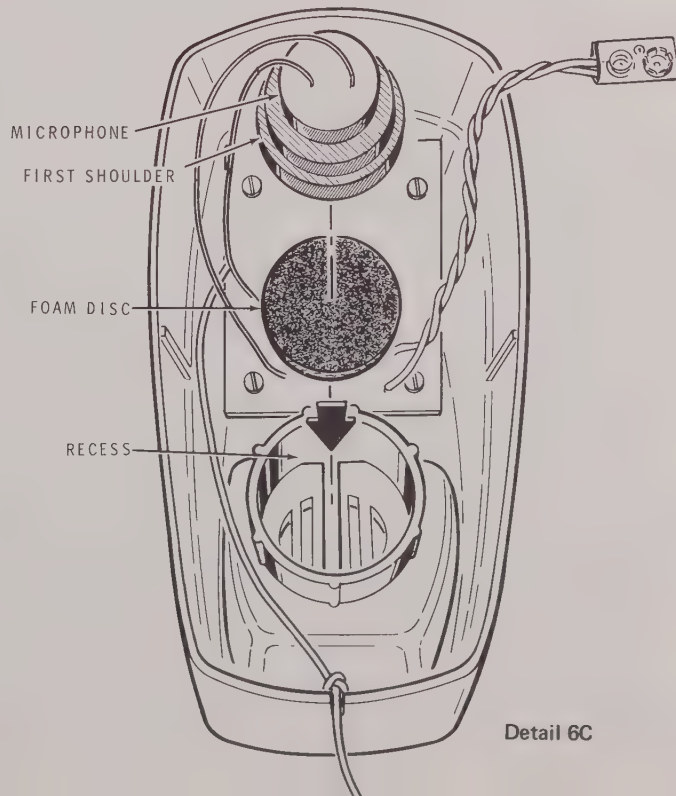
- () Refer to Detail 6C and install the foam disc and the microphone in the recess so the first shoulder will be flush with the top of the recess.



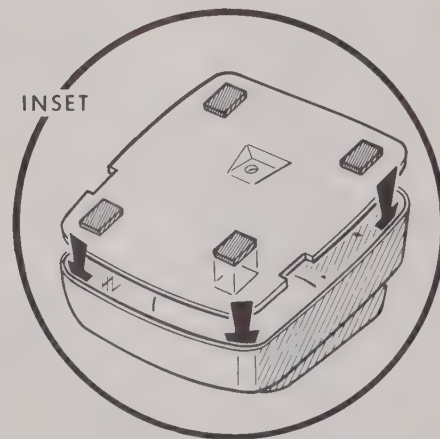
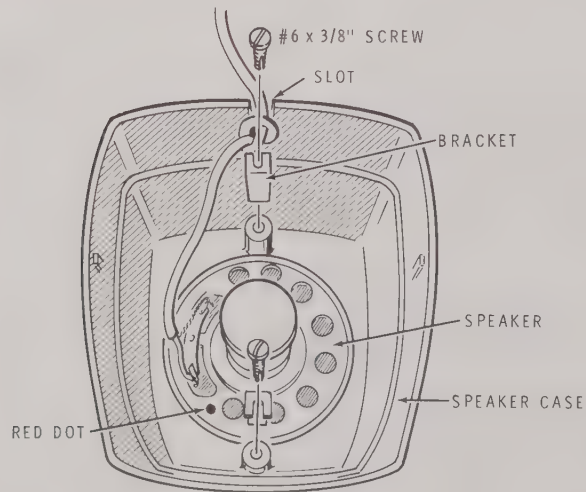
Detail 6A



Detail 6B



Detail 6C



PICTORIAL 7

Refer to Pictorial 7 for the following steps.

- () Connect the center lead of the free end of the shielded cable to the speaker lug nearest the red dot (S-1).
- () Connect the shield lead to the other speaker lug (S-1).
- () Mount the speaker in the speaker case with two #6 x 3/8" screws and two brackets. Do not overtighten the screws.
- () Carefully peel away the backing paper from a foot and press it into a foot outline on the speaker bottom panel as shown in the inset drawing. Mount a foot on each of the four outlines.
- () Route the cable through the slot, position the speaker bottom panel on the speaker case, and press it into place.



Refer to Pictorial 8 (fold-out from this page) for the following steps.

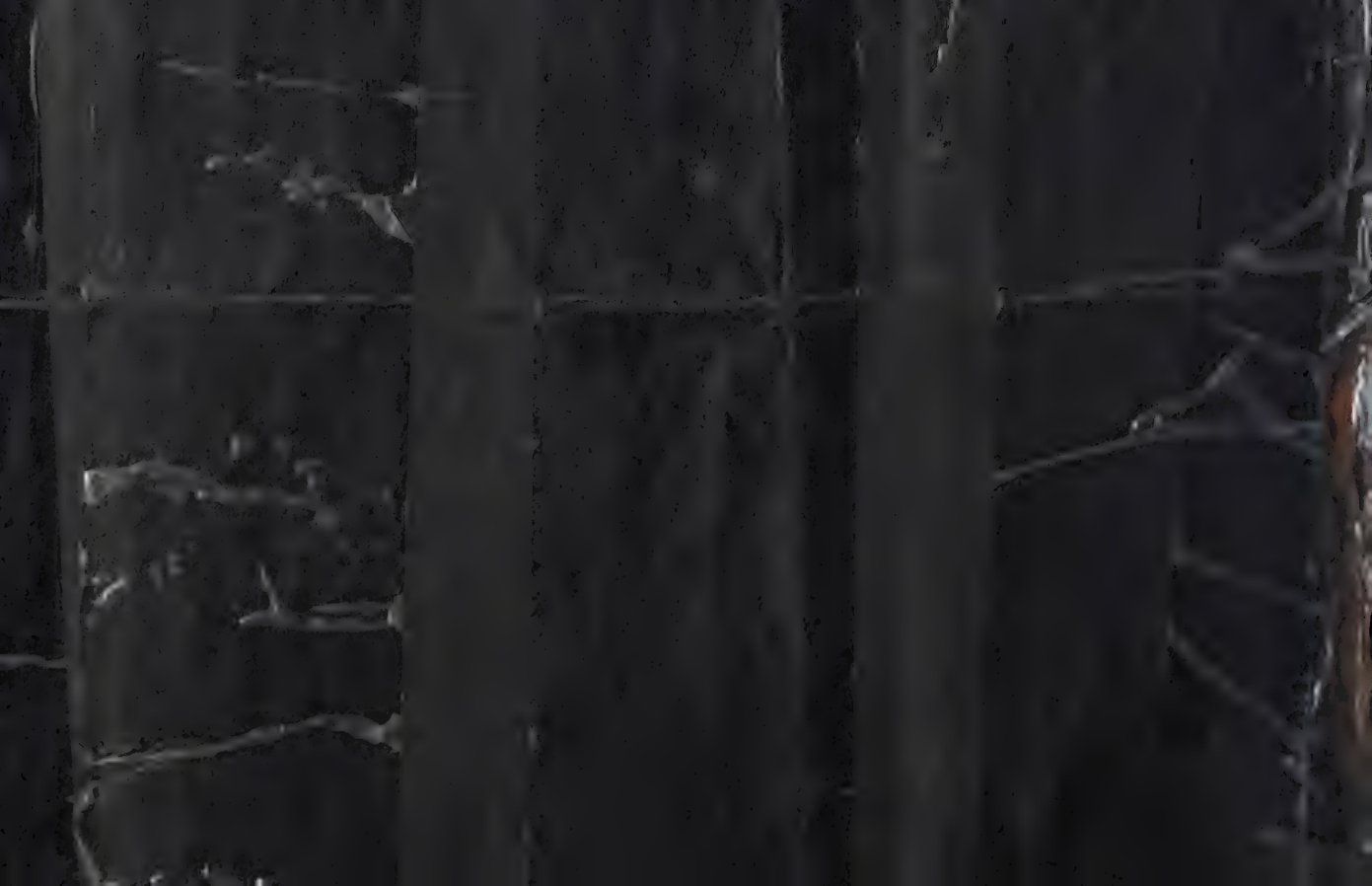
- () Twist the battery connector leads a few turns. Then connect the battery connector to the battery and place it in the battery strap. Position the leads away from the thumb knob.
- () Depress the exposed end of the contactor 1/8" and you should hear a click from the speaker as the unit turns on. It may "sing" or oscillate at this time. The click or oscillation indicates the unit is working. NOTE: If the loudness control is turned fully up (direction of the arrow) and there is no indication that the unit is working, refer to the "In Case of Difficulty" section on Page 17.
- () Temporarily place the receiver portion of your telephone handset on the pad of the Telephone Amplifier. Adjust the loudness control and you should distinctly hear the dial tone. Some areas have recorded time or temperature services you can call and use to become familiar with your unit. NOTE: If the handset does not operate the system, turning it on and off, you must readjust the contactor. In this case remove the circuit board from the amplifier case and refer to parts 2 and 3 of the step on Page 9.
- () Carefully peel away the backing paper from the pad and press it into place as shown in inset drawing #1.

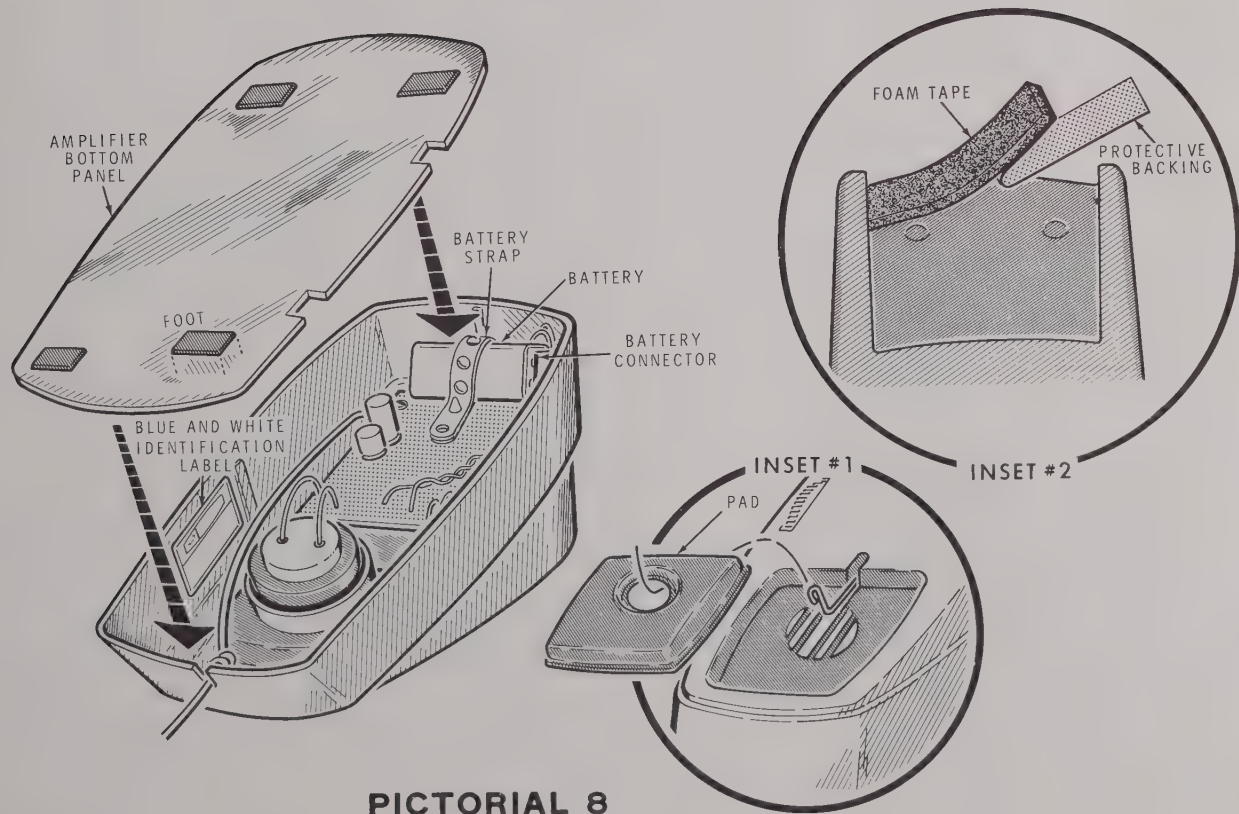
- () Remove the protective backing from the foam tape and press the tape in place as shown in inset drawing #2.

Final Assembly

- () Carefully peel away the backing paper from the blue and white identification label. Then press the label on the inside of the amplifier case. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.
- () Carefully peel away the backing paper from a foot and press it into a foot outline on the amplifier bottom panel as shown. Mount a foot on each of the four outlines.
- () Route the cable through the slot, position the amplifier bottom panel on the amplifier case and press it into place.

This completes the assembly of your Heathkit Telephone Amplifier. Proceed to the "Operation" section.





OPERATION

There are only two functions used to operate this unit, the contactor (ON-OFF switch) and the LOUDNESS control. Place the amplifier and speaker in convenient positions. Then place the receiver portion of the telephone handset on the pad of the amplifier, with the mouthpiece (end with a cord) extended over the amplifier case and nearest to you. The handset depresses the contactor and turns the unit on. Adjust the LOUDNESS control shown in Figure 1 for a desired level. NOTE: There is no amplification of the outgoing signal. You will still speak into the telephone mouth piece. Therefore, you will have to speak louder the farther you are from the telephone mouthpiece.

The unit may "sing" or oscillate at higher loudness levels. In this case reduce the LOUDNESS control, move the speaker farther away from the Amplifier, and face the speaker away from the amplifier. It also helps to be sure the handset receiver makes full contact with the pad on the Amplifier which provides a good acoustic seal for the system.

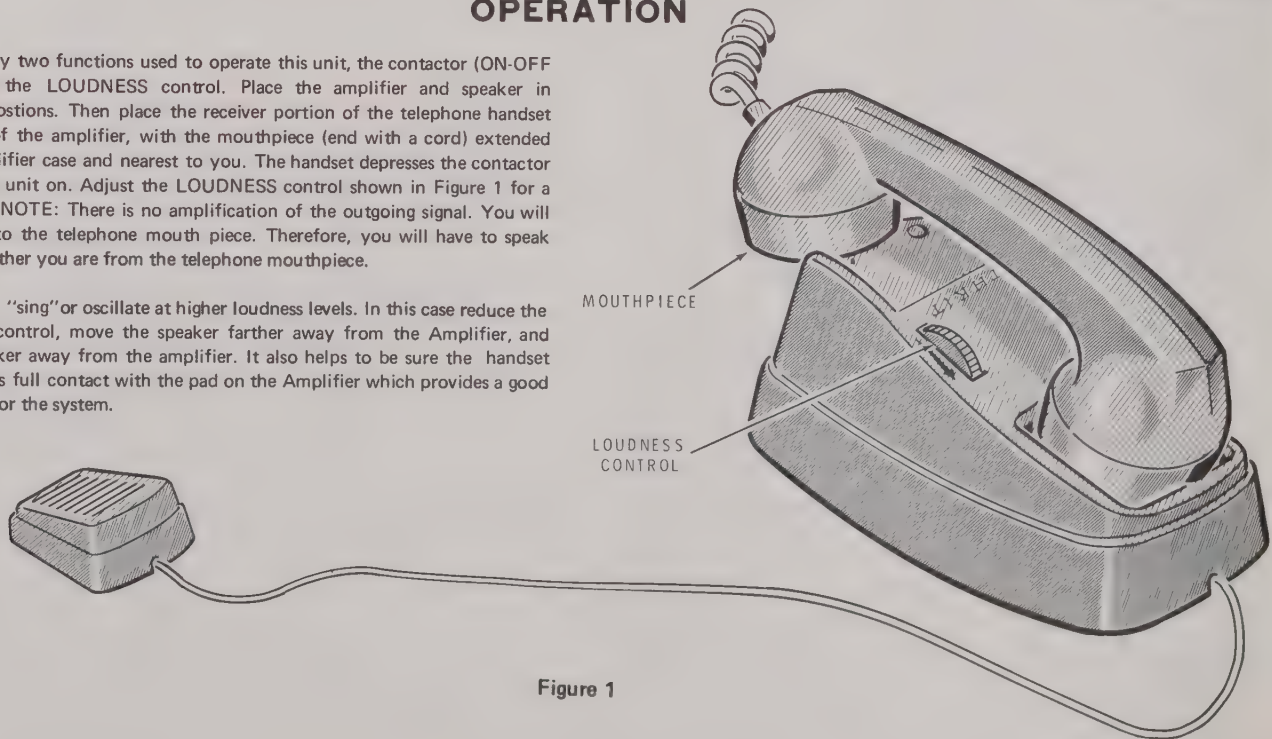


Figure 1

IN CASE OF DIFFICULTY

Generally the following visual checks apply to the initial problems that can occur. The last two checks and a "Troubleshooting Chart" will be helpful with problems that occur after the unit has been in operation.

If a voltmeter is available, you can compare the voltages on your unit with those provided on the "Voltage Chart" on Page 19.

If you still have trouble, refer to the Technical Consultation in the "Customer Service" information inside the rear cover of this Manual. Your Warranty is located inside the front cover of this Manual. If you return your kit for service, remove your battery before shipping.

VISUAL CHECKS

1. Recheck the wiring. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something you have consistently overlooked.
2. Check each circuit board foil to be sure there are no solder bridges between adjacent connections. Remove any solder bridges by holding a clean soldering iron tip between the two points that are bridged until the excess solder flows down onto the tip of the soldering iron.
3. Be sure each transistor is in the proper location (correct part number and type number). Be sure that each transistor lead is in the right hole and has a good solder connection to the foil.
4. Check capacitor values carefully. Be sure the proper part is wired into the circuit at each capacitor location. Check each electrolytic capacitor to be sure the lead near the positive (+) marking is at the correct position.
5. Check each resistor value carefully.
6. Check all component leads connected to the circuit boards. Make sure the leads do not extend through the circuit board and come in contact with other connections or parts, such as the control.
7. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by a careful inspection of connections to make sure they are soldered as described in the "Soldering" section of the "Kit Builders Guide." Reheat any doubtful connections. Be sure all the wires are soldered.
8. Check all the wires that are connected to the circuit board. Make sure all wires are properly soldered and there are no broken wires. Make sure the wires do not touch any other lugs.

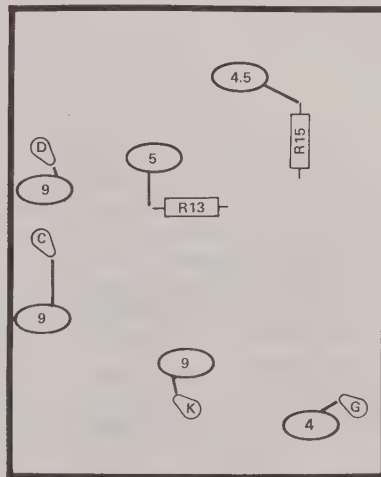
Troubleshooting Chart

Problem	Area to Check	Possible Cause
Weak signal.	Control setting.	Turned too low.
	Battery.	Too weak.
No signal.	Contactor.	Not contacting foil pad.
	Wire connections.	Loose wire or broken wire.
	Circuit board.	Connections or foil, open or shorted.

Voltage Chart

If your Telephone Amplifier does not operate properly and a Voltmeter is available, check the voltages on the circuit board in the sequence given below with the contactor depressed. If a voltage reading varies more than $\pm 20\%$ from the voltage given in the chart, make a detailed check of the items called out in the "Area to Check" column.

Check Point	Approximate Voltage	Area to Check
K	9	Battery, connector, and wires.
C	9	Contactor, battery. Check for short circuit.
D	9	Speaker, cable. Check for short circuit.
R15	4.5	Resistors R5 and R6.
R13	5	Circuit from Q2 to speaker.
G	4	Q3, Q4, and Q5.
		Q1 and its components.



(VIEWED FROM THE COMPONENT SIDE)

VOLTAGE READINGS WERE TAKEN WITH A HIGH IMPEDANCE INPUT VOLTMETER FROM THE POINTS INDICATED TO THE OUTSIDE FOIL EDGE (NEGATIVE BATTERY LEAD) VOLTAGES MAY VARY AS MUCH AS $\pm 20\%$.

SPECIFICATIONS

Power Requirements	9-volt battery (NEDA #1604) 5–30 mA.
Battery Life	Estimated 25 hours. (500 three-minute calls.)
Power Output	Approximately 100 mW.
Circuit	5 transistors with complementary — symmetry output.
Input	200 Ω dynamic Microphone.
Output	2-1/4", 45 Ω , PM dynamic speaker.
Controls	On-Off contactor — telephone handset actuated. Loudness — thumbwheel control.
Overall Dimensions (Approximate)	
Amplifier	7-3/4" long x 4" wide x 3" high.
Speaker	3-3/4" long x 3-1/2" wide x 2" high.
Net Weight	1 lb.

The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

CIRCUIT DESCRIPTION

As you read this description refer to the Schematic drawing (fold-out from Page 23).

This battery-operated Telephone Amplifier circuit consists of a microphone, a preamplifier, a four transistor output stage and a speaker.

PREAMPLIFIER

The audio signal picked up by the microphone is coupled through capacitor C1 and a low-pass filter, resistor R1 and capacitor C2, to the base of transistor Q1. Resistor R2 provides base bias for transistor Q1. A portion of the amplified signal at the collector of Q1 is selected by control R3 and is then coupled through resistor R4 and capacitor C4 to the base of transistor Q2.

OUTPUT STAGE

Resistors R5 and R6 form a voltage divider that sets the base of transistor Q2 at a reference level for the following stages. The amplified signal from the collector of Q2 is direct-coupled to the base of driver transistor Q3 where it is amplified and direct coupled to the output transistors. The bases of these transistors are practically in parallel. Resistor R13 only provides the voltage drops for the

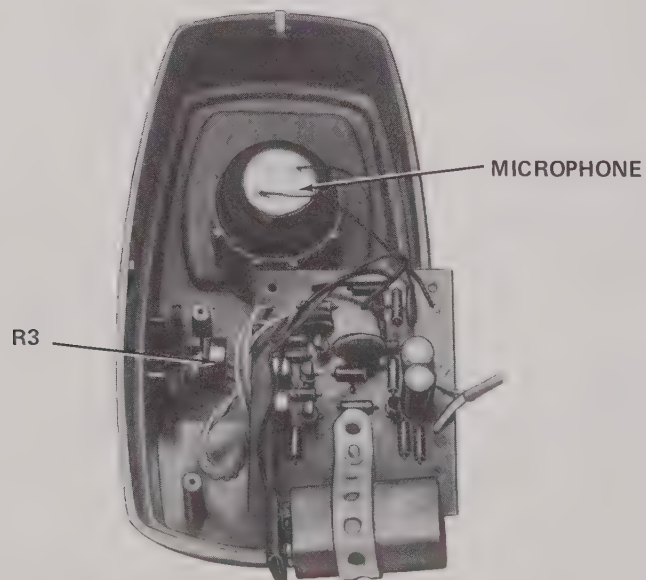
base-emitter junctions of Q4 and Q5. Output transistors Q4 and Q5 are connected in a complementary – symmetry emitter follower circuit.

The audio signal in the base circuit of the output transistors causes Q4 and Q5 to alternately conduct at the rate of the input signal. This resulting signal is coupled through capacitor C8 to the speaker voice coil.

Resistor R12 is connected in a bootstrap circuit between the amplifier output and the base of Q4 to provide full drive to Q4 during the positive half-cycle. Resistors R8 and R9 form a divider in a feedback loop that applies 100% DC and a proportionate AC negative feedback to the emitter of Q2. The divider ratio sets the gain, which is practically independent of the transistors. This reduces distortion and stabilizes amplifier operation. Capacitor C6 stabilizes the amplifier at higher frequencies by increasing the feedback and lowering the gain. Capacitor C7 blocks the DC and maintains an AC network.

The effects of wide current drain variations of the class B output are thoroughly filtered by resistor R7 and capacitor C3 to provide a clean supply for the preamplifier and driver. Capacitor C5 keeps the battery supply a low impedance source to audio signals and prevents oscillations.

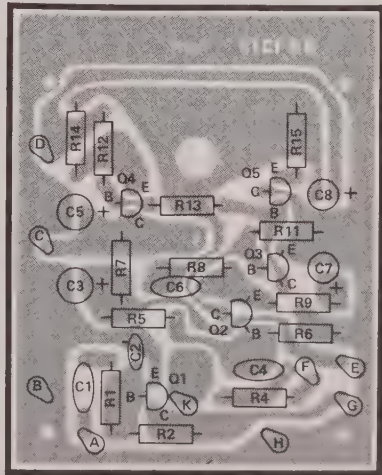
CHASSIS PHOTOGRAPH



CIRCUIT BOARD X-RAY VIEW

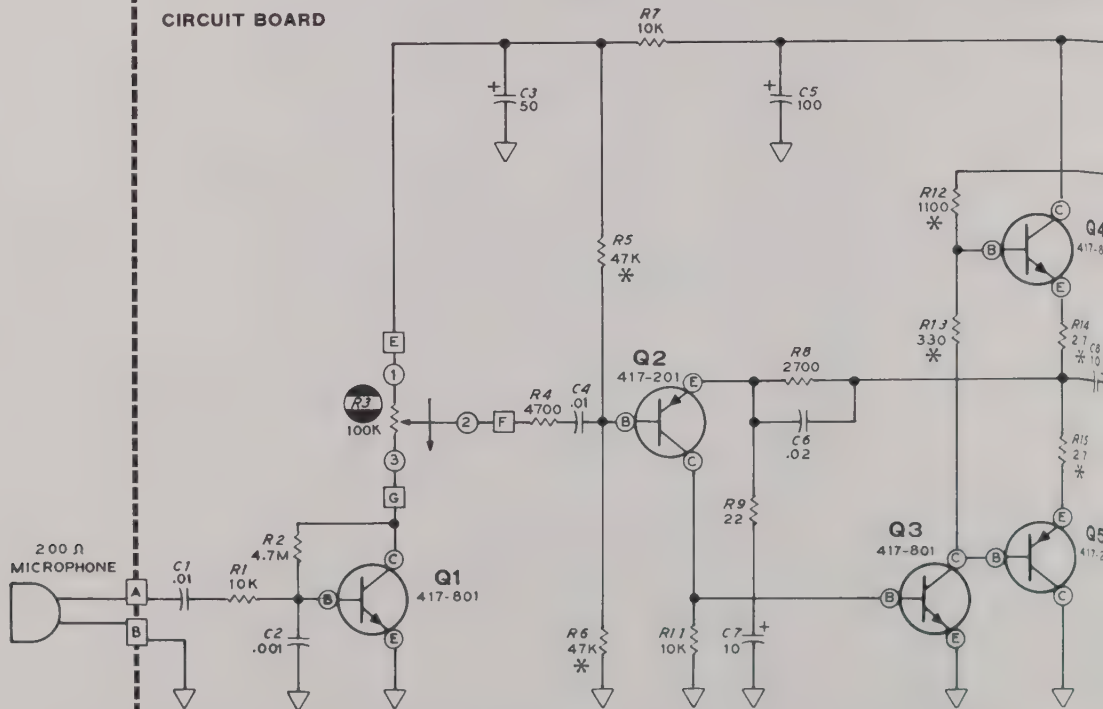
NOTE: To identify a part shown in this View, so you can order a replacement, proceed in either of the following ways:

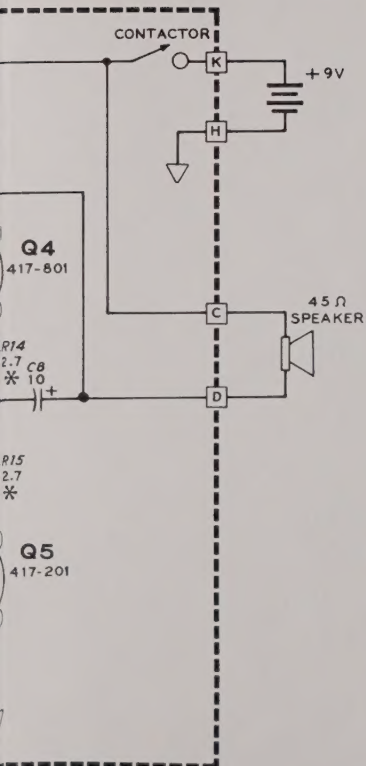
1. A. Refer to the place where the part is installed in the Step-by-Step instructions and note the "Description" of the part (for example: 22 Ω , .02 μ F, or MPSA20).
- B. Look up this Description in the "Parts List."
2. A. Note the identification number of the part (R—number, C—number, etc.).
- B. Locate the same identification number (next to the part) on the Schematic. The "Description" of the part will also appear near the part.
- C. Look up this Description in the "Parts List."



(Shown from component side)

CIRCUIT BOARD





SCHEMATIC OF THE HEATHKIT® TELEPHONE AMPLIFIER

NOTES:

CUSTOMER SERVICE

REPLACEMENT PARTS

If you need a replacement part, please fill in the Parts Order Form that is furnished and mail it to the Heath Company. Or, if you write a letter, include the:

- Part number and description as shown in the Parts List.
- Model number and Series number from the blue and white label.
- Date of purchase.
- Nature of the defect.

Please do not return parts to the factory unless they are requested. Parts that are damaged through carelessness or misuse by the kit builder will not be replaced without cost, and will not be considered in warranty.

Parts are also available at the Heathkit Electronic Centers listed in your catalog. Be sure to provide the Heath part number. Bring in the original part when you request a warranty replacement from a Heathkit Electronic Center.

NOTE: Replacement parts are maintained specifically to repair Heathkit products. Parts sales for other reasons will be declined.

TECHNICAL CONSULTATION

Need help with your Heathkit? Self-Service? Construction? Operation? Call or write for assistance. You'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek. . . please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit C.O.D. for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

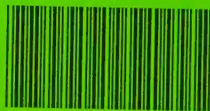
Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

HEATH

Schlumberger

MP MASTER



MA22768

HEATH COMPANY • BENTON HARBOR, MICHIGAN
THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

LITHO IN U.S.A.